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IN THE U.S. PATENT AND TRADEMARK OFFICE

Applicants: Hidetoshi SAITO et al.

Serial No.: 09/647,489

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For: FUNCTIONAL ELEMENT FOR USE IN AN ELECTRIC, AN ELECTRONIC OR AN OPTICAL DEVICE AND METHOD FOR PRODUCING THE SAME

Art Unit: 1775

Examiner: Jason L. Savage

DECLARATION UNDER 37 C.F.R. 1.132

I, the undersigned, Yoshikazu UEDA, a Japanese citizen, residing at Asahi Kasei Ookubo Shataku 2-tou 225, 36-2, Oo-kubo 3-chome, Konan-ku, Yokohama-shi, Kanagawa-ken 233-0007, Japan, hereby declare and state that:

I majored in petrochemistry at the engineering course, the Graduate School, Kyoto University, and I was graduated therefrom in March 1989.

I entered Asahi Kasei Kabushiki Kaisha in April 1989.

I was engaged in the research and development of polymer alloys from April 1989 to July 1991. I was engaged in the research and development of olefin polymer resins from July 1991 to January 1996. I was engaged in the research and development of styrene polymer resins from January 1996 to March 1998. I was engaged in the research and development of uses for new inorganic metal oxides from April 1998 to October 1999. I was engaged in the research and development of technology for the recycling of plastics from October 1999 to November 2001. I was engaged in the research and development of polycarbonate resins from December 2001 to June 2002. I have been engaged in the research and development of uses for new inorganic materials from July 2002 to date.

I am one of the applicants of the above-identified application and I am well familiar with the present case.

I have read and understood the Office Action dated June 20, 2002 and the references cited therein.

I carried out Examples 1 to 7 and Comparative Example of the present specification, and the results are as described on pages 79 to 90 of the specification of the present application.

I have performed an experiment to show that **the featur** (in claim 9 of the present application) that the heating temperature of the substrate **is higher than** the temperature of the metal compound gas **is critical for** producing the functional element of the present invention. The method and results of the experiment are as described in a paper attached hereto and marked "Exhibit 1".

The procedure of the experiment of Exhibit 1 is a slight modification of the procedure of Example 1 of the present specification. In Example 1 of the present specification, a functional element was produced under reaction conditions wherein the metal compound (zinc acetylacetonate) was gasified at **115 °C** (i.e., the temperature of the metal compound gas was 115 °C), and the substrate was heated to **550 °C**.

In the experiment of Exhibit 1, substantially the same procedure for producing a functional element as in Example 1 of the present specification was repeated **except that the substrate was heated to 115 °C**, which is **the same as** the temperature of the metal compound gas (i.e., gasified zinc acetylacetonate). That is, in this experiment, **the feature** in claim 9 that the heating temperature of the substrate is **higher than** the temperature of the metal compound gas was <u>not</u> satisfied.

As a result, <u>no</u> metal oxide needles could be grown on the surface of the substrate. Therefore, a functional ele-

ment of the present invention could not be obtained.

From the above-mentioned results of Exhibit 1, it can be fairly concluded that **the feature** in claim 9 that the heating temperature of the substrate is **higher than** the temperature of the metal compound gas **is critical for** producing the functional element of the present invention.

The undersigned petitioner declares further that all statements made herein of his own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Date:_____ _____

Yoshikazu UEDA

Exhibit 1

An experiment to show that **the feature** (in claim 9 of the present application) that the heating temperature of the substrate is **higher than** the temperature of the metal compound gas **is critical for** producing the functional element of the present invention

1. Object of the experiment:

The object of the experiment of this Exhibit 1 is to show that **the feature** (in step (b) of the method of claim 9 of the present application) that the heating temperature of the substrate is **higher than** the temperature of the metal compound gas **is critical for** producing the functional element of the present invention.

2. Explanation:

In item 3. below, reference is made to Example 1 of the present specification (described at page 79, line 14 to page 81, line 2 of the present specification). For easy reference of the procedure of Example 1 of the present specification, the description of Example 1 is reproduced below.

"Example 1

Using a system as shown in Fig. 1, a functional element was produced as follows. Zinc acetylacetonate ($Zn(C_5H_7O_2)_2$) was charged into a metal com-

pound-heating vessel. The vessel was heated to gasify the zinc acetylacetonate under conditions wherein the internal temperature of the vessel was 115 °C. A single crystal plate (Al_2O_3) as a substrate, having a size of 10 mm x 5 mm, was placed on a heater located just under a blow-off slit of a nozzle so that the (0001) face of the Al_2O_3 single crystal faced the slit. The substrate was heated to 550 °C by means of the heater. Dry nitrogen gas was introduced into the metal compound-heating vessel at a flow rate of 1.2 dm^3/min. The gasified zinc acetylacetonate in the vessel, entrained by the nitrogen gas, was applied through the blow-off slit of the nozzle onto the surface of the Al_2O_3 single crystal plate under atmospheric pressure, thereby growing metal oxide (ZnO) needles on the surface of the substrate. 300 minutes after the start of the application, a functional element comprising the substrate and, grown on the surface thereof, a plurality of the metal oxide (ZnO) needles was obtained, which was then removed from the system.

Gold (an electroconductive substance) was vapor deposited on the functional element by sputtering at a thickness of 0.1 μm. Then, an observation of the functional element was conducted using a scanning electron microscope (hereinafter referred to simply as an "SEM").

In order to elucidate the three-dimensional structure of the functional element, SEM photomicrographs showing perspective views of the obtained functional element were taken, and shown in Figs. 2 (a) and 2 (b). The metal oxide (ZnO) needles had a weighted average circle-based diameter of 1.2 μm, a weighted average length of 100 μm and a density of 500 needles per unit area having a size of 10 μm x 10 μm. Further, the leaning angles of the crystal axes of the metal oxide needles were each 0.9 degree." (emphasis added)

As seen from the above, in Example 1 of the present specification, the metal compound (zinc acetylacetonate) was gasified at **115 °C** (i.e., the temperature of the metal compound gas was 115 °C), and the substrate was heated to **550 °C**.

3. Method and Results:

Substantially the same procedure for producing a functional element as in Example 1 of the present specification was repeated **except that the substrate was heated to 115 °C**, which is **the same as** the temperature of the metal compound gas (i.e., gasified zinc acetylacetonate). That is, in this experiment, **the feature** in claim 9 that the heating temperature of the substrate is **higher than** the temperature of the metal compound gas was not satisfied.

As a result, no metal oxide needles could be grown on the surface of the substrate. Therefore, a functional element of the present invention could not be obtained.

4. Conclusion:

The feature in claim 9 that the heating temperature of the substrate is **higher than** the temperature of the metal compound gas **is critical for** producing the functional element of the present invention.

Amdt of Paper #6

Exhibit 2

DECLARATION OF TRANSLATOR

I, Kenji KABUKI, c/o the Inoue & Associates of 3rd Floor, Akasaka Habitation Building, 3-5, Akasaka 1-chome, Minato-ku, Tokyo, Japan do solemnly and sincerely declare that I am well acquainted with the Japanese and English languages and that the attached text is a true partial English translation of Unexamined Japanese Patent Application Laid-Open Specification No. Sho 50-6597.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

November 7, 2002
(Date)

Kenji Kabuki
Kenji KABUKI

Exhibit 2

Partial English Translation of Unexamined Japanese Patent Application Laid-Open Specification No. Sho 50-6597

(1) Front page (page 469), upper portion:

(19) Japanese Patent Office

Laid-Open Patent Gazette

(11) Unexamined Japanese Patent Application Laid-Open Specification No. Sho 50-6597

(43) Laying-open date: January 23, 1975

(21) Patent Application No. Sho 48-57371

(22) Filing date: May 22, 1973

Request for examination: not yet filed

(3 pages in total)

Applicant: Toyota Central Research & Development Laboratories Incorporated

Representative: Hanji Umehara

(2) Front page (page 469), left-hand lower column, lines 3 to 10:

1. Title of the Invention

Method for producing zinc oxide whiskers

2. Scope of Claim for Patent

A method for producing zinc oxide whiskers, in which a zinc alloy of zinc and a metal having a boiling point higher than that of zinc or a mixture of these two metals is heated under an oxygen-containing atmosphere in the presence of a substrate, to thereby form zinc oxide whiskers on a surface of said substrate.

(3) Front page (page 469), left-hand lower column, lines 11 to 15:

3. Detailed description of the invention

The present invention relates to a method for easily producing zinc oxide whiskers.

Examples of uses of zinc oxide whiskers include reinforcements for various materials, and semiconductors.

(4) Second page (page 470), right-hand upper column, lines 2 and 3:

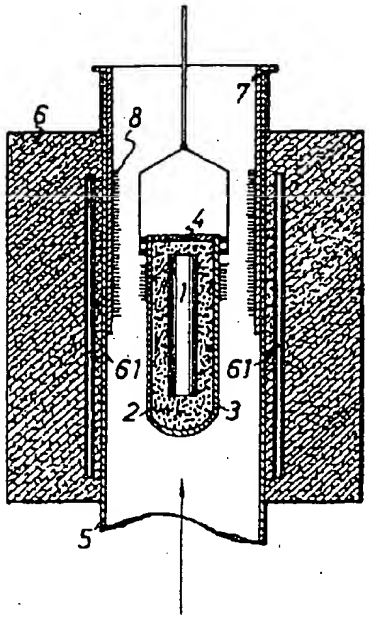
In the method of the present invention for producing whiskers, it is preferred that the heating temperature is from about 900 °C to 1,400 °C.

(5) Second page (page 470), left-hand lower column, lines 9 to 17:

Example

Zinc oxide whiskers were produced from a zinc-copper alloy, as follows.

There were provided 3 rods of zinc-copper alloys wherein the 3 rods respectively had Zn/Cu weight ratios indicated in the Table below. The 3 rods were individually used. As shown in the figure below, each rod 1 was placed in a Tammann tube 3 having an inner diameter of about 60 mm, and the Tammann tube 3 containing the rod 1 was placed in a siliconite furnace 6 having, disposed on the inside surface thereof, a cylindrical substrate 7 made of mullite. The Tammann tube 3 containing the rod 1 was heated in the furnace 6, thereby growing zinc oxide whiskers 8 on the inside wall of the cylindrical substrate 7.



(6) Second page (page 470), right-hand lower column, line 2 from the bottom to the third page (page 471), left-hand upper column, lines 1 to 4 and the Table:

The obtained whiskers were collected, and the properties of the whiskers were measured. With respect to each of the 3 rods made of 3 different zinc-copper alloys, the results of the measurement are shown in the Table below. Also shown in the Table below are the heating temperatures for growing the whiskers, and the growth time of the whiskers. The "growth time" means the time for which a rod of zinc-copper alloy, together with the cylindrical substrate 7, is maintained at a heating temperature.

Table

No.	Alloy formulation (wt%)		Temperature (°C)	Time (hour)	Properties of whisker	
	Zn	Cu			length (mm)	diameter (μ)
1	20	80	1,250	4	10 to 20	30 to 80
2	30	70	1,200	4	10 to 30	20 to 40
3	40	60	1,150	2	2 to 5	1 to 10

(7) Third page (page 471), left-hand upper column, lines 1 to 6 as counted from below the Table:

Thus, by the method of the present invention, excellent zinc oxide whiskers can be obtained easily in a short time. Further, when the whiskers obtained under the conditions No. 2 shown in the Table above were measured with respect to tensile strength, the whiskers were found to have a tensile strength as high as from about 50 to 200 kg/mm^2.